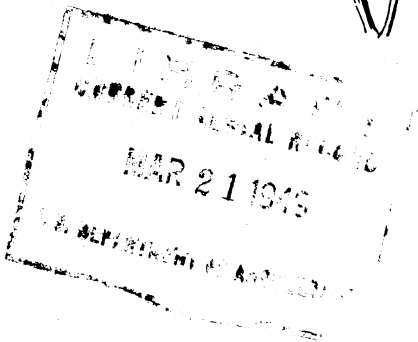


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# BUR-CLOVER CULTIVATION AND UTILIZATION



FARMERS'  
BULLETIN  
No. 1741

U. S. DEPARTMENT OF AGRICULTURE

**B**UR-CLOVERS are winter annual legumes useful for pasture and green manure. Readily maintaining themselves with little or no reseeding each year, they add humus and nitrogen to the soil and still permit the planting of a regular summer crop.

These legumes will grow successfully only in the mild climates of the Pacific coast and of the cotton-growing area of the South. They require moderately fertile soil. In the South it is usually necessary to inoculate the seed before it is planted. In the West most soils seem to be well inoculated.

Where bur-clover can volunteer from year to year in cultivated land it affords one of the best and cheapest cover crops, and its use as such prevents the washing of the soil, especially in the South.

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# BUR-CLOVER CULTIVATION AND UTILIZATION

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## INTRODUCTION

**BUR-CLOVERS** are annual legumes, much like ordinary clovers, but the small yellow flowers are in clusters of 5 to 10, and the coiled pods are commonly beset with spines, thus forming the so-called bur. The roots are fibrous and do not extend very deep. Most of the plants are branched at the crown and have 10 to 20 or more spreading, or decumbent, branches 6 to 30 inches long, which when in fruit are thickly beset with burs. Well-developed plants may contain more than 1,000 pods. Bur-clovers are valuable agriculturally only where the winters are mild—in the United States in the cotton-growing area of the South and all of the Pacific coast west of the Cascade and Sierra Nevada mountain ranges.

Bur-clover is highly regarded, particularly because it so readily maintains itself with little or no reseeding, and because each year it can be depended on to add humus and nitrogen to the soil and still permit the growing of a regular summer crop. For the South, especially, bur-clover is the cheapest legume that serves as a winter cover crop, thus preventing the washing of the soil. In addition to its value as a winter cover crop, it furnishes some pasture and improves the soil. Many instances are reported in which the cotton crop has been materially increased each season by the use of bur-clover alone.

## KINDS OF BUR-CLOVER

There are two species of bur-clover commonly cultivated in the United States, namely, the spotted or southern bur-clover (*Medicago arabica*; fig. 1) and the California or toothed bur-clover (*M. hispida*;

fig. 2). Tifton bur-clover (*M. rigidula*) is a more recently introduced species that has been grown and distributed from the Georgia Coastal Plains Experiment Station, located at Tifton, Ga., but has not yet become established commercially. Another species, little bur-clover (*M. minima*), has been naturally introduced in a number of places in the Southern States and is gradually spreading. Little bur-clover is comparable with spotted bur-clover in winter hardiness, but Tifton bur-clover is the most hardy of all and usually will survive most winters as far north as Washington, D. C.



Figure 1.—Spotted bur-clover.

The Tifton bur-clover is readily distinguished by its hard, spiny, comparatively large bur, while little bur-clover is readily recognized by its very small and soft spiny bur. The spotted, or southern, bur-clover is distinguishable by the reddish-brown spot in the center of each leaflet. Toothed bur-clover has no outstanding features; it is readily distinguished, however, from the spotted bur-clover, which it most nearly resembles, by the lack of the large reddish-brown spot in the center of the leaf and by differences in bur characters (figs. 3 and 4). A pod of spotted bur-clover contains from 2 to 8 seeds; in California bur-clover the usual number is 3, but there are often as many as 5.

In addition there are about 35 other species, some of which have large, smooth burs, while others have very hard and spiny burs. All of these are native to the Mediterranean region, although a few occur

naturally as far eastward as Turkmen S. S. R. There are a number of varieties of both the spotted and California bur-clover differing in general appearance and date of maturity. Manganese and Giant bur-clover are early-maturing forms of spotted bur-clover with the red-dish-brown spot in the center of the leaflet considerably enlarged. There is also a variety of the spotted bur-clover with spineless pods,



Figure 2.—California bur-clover.



Figure 3.—Pods of spotted bur-clover.

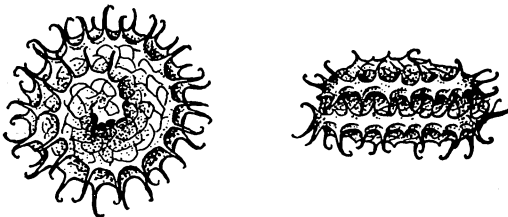


Figure 4.—Pods of California bur-clover.

and several similar varieties of the California bur-clover. These spineless forms, together with species with large spineless burs, as button-clover (*M. orbicularis*), snailclover (*M. scutellata*), and cogwheel clover (*M. tuberculata*), have been tested to determine their value as compared with the spiny species. A form of buttonclover that is much more winter-hardy than most bur-clovers has become naturalized in north-central Tennessee.

### VALUE OF SPINELESS BUR-CLOVERS

In experimental plantings under cultivation, the spineless, spotted, California, and other bur-clovers have all made good growth and matured good crops of seed. Under pasture conditions they make good growth and mature seed when not grazed too closely during the fruiting season. Experience has shown, however, that the varieties with large spineless burs cannot be maintained in pastures, except when given special attention and protection. The seed of spineless varieties with small burs escape grazing animals more readily and, consequently, are more persistent and more common in California.

Since the spiny varieties of bur-clover are now widely distributed in areas where bur-clovers are adapted, any plantings of spineless varieties would soon be mixed with those having spines. It appears, therefore, that there is no practical value in these spineless forms.

### CLIMATIC ADAPTATIONS

All of the bur-clovers are normally winter annuals; that is, in the country to which they are native they germinate in the autumn, grow during the fall, winter, and early spring, and mature early in the summer. They are thus primarily adapted to regions with mild, moist winters. In this country they maintain themselves naturally only in the areas shown by the shading in figure 5. Northward from

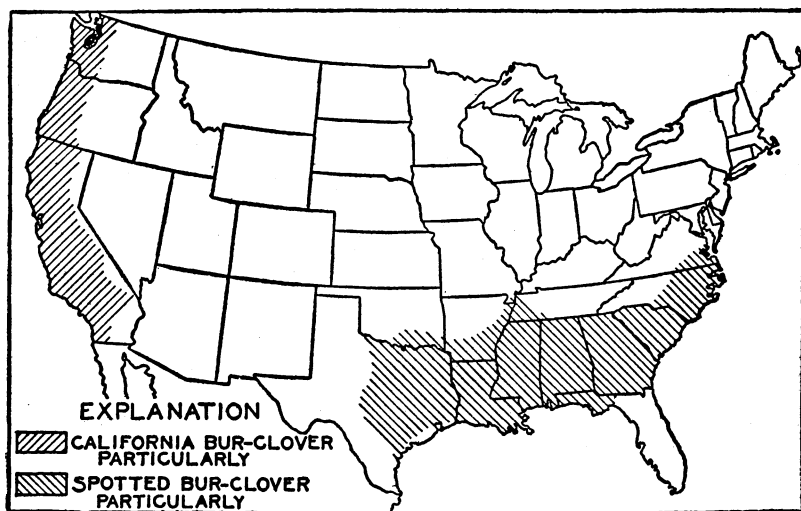


Figure 5.—Outline map of the United States, showing the regions to which bur-clover is adapted.

the areas indicated bur-clovers succeed fairly well when the seed is sown in the spring but are scarcely able to maintain themselves by reseeding from year to year.

On the Pacific coast, especially in California, along streams and in shady places, spotted bur-clover is now nearly as abundant as California bur-clover. In the Southern States spotted bur-clover is decidedly better adapted to that area than California bur-clover. The California species, however, appears able to maintain itself from year to year in the less humid parts of eastern Texas and in parts of southern Oklahoma. There is also evidence to indicate that California bur-clover is destroyed in winter by temperatures that do little or no harm to the spotted bur-clover. This variety, therefore, is to be preferred in the cotton States, where California bur-clover cannot be so highly recommended. In the Pacific coast area, from Oregon south to Arizona, and in the Great Plains area of eastern Texas and southern Oklahoma bur-clover is a valuable winter annual pasture plant and is especially well thought of throughout that region for its high feeding value.

Bur-clover may be pastured in North Carolina by the middle of February, and near the Gulf coast it furnishes practically continuous winter pasture. Few legumes will make more growth in that area during cool weather.

### **SOIL PREFERENCES**

Bur-clover will succeed in practically all types of soil, but loams are most suitable. In the South the plants grow best in soils rich in lime, but they thrive well enough in soils poor in this substance. Apparently the plant is not indifferent to lime, but it will succeed in somewhat acid soils. As a rule it prefers moist, well-drained soils, but in California it grows vigorously in adobe soils, which are often poorly drained. Where the soil is very moist the plants mature much later than on well-drained land. The California Agricultural Experiment Station found that California bur-clover would grow luxuriantly in alkali soil containing 11,300 pounds of carbonate of soda to an acre in the top 30 inches. Apparently the plant is as tolerant of alkali as is barley. In general, bur-clover succeeds well in slightly alkaline soils, but not in those heavily charged with salts.

### **FERTILIZER REQUIREMENTS**

Bur-clover does poorly on soils of low fertility. In establishing stands, except on very fertile soils, the use of liberal quantities of stable manure or commercial fertilizer is recommended. Usually superphosphate is the most essential fertilizer ingredient, and the use of 400 pounds per acre of this is all that is needed. In some cases potash is beneficial, and on very poor soils the addition of nitrogen will give increased growth. Boron has given increased growth in southern Alabama.

### **TIME OF SEEDING**

Bur-clover should always be sown late in summer or fall. In the cotton States the best time of seeding is the months of August and September when seed in the bur is used, but seedings as late as November may give favorable results, even as far north as South Carolina.



Late seedings, however, are to be avoided whenever possible, as but little fall and winter growth is obtained from such plantings. Hulled seed germinates more readily than seed in the bur, so that where hulled seed is used the time of sowing may be delayed on an average from 2 to 4 weeks longer than if seed in the bur is used.

In California, where the summers are always dry, seeding may be delayed until just before the fall rains begin. If the sowings are to be made on irrigated land, the best average date is about the first of October, since by seeding at this time only a single irrigation is ordinarily necessary; that is, the one made just before seeding. If the seeding is done earlier, a second irrigation may be necessary before the rains come; otherwise the young plants are likely to be injured by drought.

### **SOWING OF SEED**

Hulled seed may be sown by a grain drill with a press-wheel attachment, or by any method of broadcasting, about 15 pounds of seed being used per acre. A firm seedbed is essential, and especial care should be taken to cover the seed thinly. Under most conditions broadcasting will be found most satisfactory, but the seed should be harrowed lightly. Where moisture conditions are entirely favorable, good stands have frequently been obtained by merely scattering the seed on the surface, but whenever practicable harrowing is recommended.

When the seed is sown in the bur, broadcasting is the only practicable method. To obtain a full stand by this method, from 5 to 10 bushels of seed per acre are necessary, followed by a harrowing.

In the regions that are well adapted to bur-clover it is much more economical as a rule to begin with a light seeding and to depend in subsequent years on the volunteer crop, where this is practicable.

### **GERMINATION OF THE SEED**

Bur-clover seed in the bur retains its vitality for a number of years. Hulled seed deteriorates more readily but usually gives a high percentage of germination for 3 years or more. In all cases, seed in the bur contains a high percentage of hard seeds, most of which do not germinate until the second year or later. Hulled seed usually germinates readily. On account of the high percentage of hard seed it contains, unhulled seed often gives poor stands, and for this reason hulling or special treatment to induce germination is recommended.

Investigations have shown that this difficulty of germination can be largely overcome by treating the seed in the bur with boiling water before it is sown. As a result of these investigations, the following method is recommended: (1) Empty a bag of the burs into a tub of cool water and let them stand for 2 hours, stirring occasionally to loosen as much dirt as possible for reinoculating the burs at the end of the hot-water treatment; (2) remove the burs from the tub of cool water, put them in a bag, and immerse for 5 minutes in a barrel of water almost scalding hot; (3) plunge the bag of burs for 1 minute in water kept boiling hot; (4) lift the bag of burs from the boiling water and plunge into a barrel of cool water. Sow the seed immediately or spread it out to dry as rapidly as possible in an airy, shady place.

## INOCULATION

On the Pacific coast, where bur-clover is established, practically everywhere inoculation occurs naturally. In the cotton States, however, lack of inoculation apparently has often been the cause of failure in establishing bur-clover crops. During the past two decades (1928-48) new facts have been learned about the root nodule organisms commonly called legume bacteria. Formerly when nodules were found on legume plant roots the crop was considered to be inoculated and the legume to be a soil builder, because the bacteria fixed air nitrogen in a form that the plants could use for their growth. Now it is known that there are strains of legume bacteria for a given legume that fix varying quantities of nitrogen—some are high nitrogen fixers, some good, some poor, and some form nodules but do not fix any nitrogen. Farmers have no quick way of telling whether the legume bacteria living over in the soil are the most effective type or whether they are ineffective.

Some farmers have had varying degrees of success in using soil for inoculating new seedings of legumes. This practice is not generally recommended, because it is not known whether the soil contains the most effective legume bacteria in sufficient numbers to produce maximum benefits and because of the danger of spreading plant diseases and weed seeds from field to field.

One fundamental purpose of legume inoculation is to add a fresh culture of effective strains of legume bacteria to the seed, so that when the young plants begin to grow, the bacteria will be right there to enter the tiny root hairs and begin fixing nitrogen in the early stages of the plant's growth. Farmers can now purchase legume inoculants prepared with superior and selected strains of bacteria for different legumes, and therefore the simplest, easiest, and most economical way to insure successful growth is to inoculate legume seeds with these cultures before each planting. For additional information on legume inoculation, see Farmers' Bulletin 2003, Legume Inoculation: What it is, What it Does.

## VOLUNTEER CROPS OF BUR-CLOVER

One of the advantages of bur-clover over most other legumes is the fact that good stands can often be obtained from year to year without additional seeding. On pasture lands, where once established, bur-clover will reseed itself indefinitely.

On cultivated land the same thing is true, provided the land is not plowed until some of the burs have ripened. However, for most summer crops as commonly planted it is impractical to allow the bur-clover to remain on the land long enough to produce a crop of seed each season. This is particularly true of corn and cotton. With these and other row crops, stands of bur-clover for the succeeding fall can be obtained when the plantings of row crops are in wide rows (4 to 5 feet) that make possible the seeding of the current year's corn or cotton between the old rows that are left as "balks" in which the bur-clover can mature and be worked down later.

With rows of cotton 6 or 7 feet wide it is possible to interplant with cowpeas or soybeans after the matured bur-clover has been plowed down. The dried bur-clover plants should be turned under rather

shallowly because, if the seeds are buried deeply, the stand will probably be thin. On the whole, however, it is better to grow the seed in a separate patch, gather it when ripe, and sow in the cultivated crop where desired. If once in 5 years the bur-clover is allowed to mature, it can be followed with late-planted corn and in this way a good volunteer crop of bur-clover can be assured for the intervening years. Bur-clover seed will retain its vitality in the soil for a long term of years, so that where it once is well established volunteer stands are common.

### **BUR-CLOVER FOR PASTURES**

Bur-clover is utilized mostly as pasture for hogs, cattle, sheep, and poultry. Farm animals do not eat it readily at first, but they soon acquire a taste for the plant and then eat it freely. In Argentina, where both the California and the spotted bur-clover occur, it is said that horses will eat the California species quite readily but absolutely avoid the spotted bur-clover. No similar observations have been recorded for California, where the two species grow together. When bur-clover is growing in cultivated lands it is best not to pasture continuously, but to put the stock on the land for only a few hours each day, as this reduces very much the injury by trampling. Few cases have been recorded of bur-clover causing bloat, but where the growth is lush care should be exercised. Not only do animals eat the herbage, but sheep, especially, are very fond of the ripe pods and will lick them from the ground. Much of the value of range lands in California depends on the large crop of pods produced by the bur-clover, which remain in good condition a long time. When the burs are abundant in the pasture, sheep fatten very rapidly. The spines bother the animals only slightly, but the burs are eaten more readily when they have been softened by rain.

For permanent pastures in the South, a combination of bur-clover and Bermuda grass is very satisfactory. The Bermuda grass furnishes pasture during the warm weather until further growth is stopped by frost, whereas the bur-clover begins to grow with cool weather in the fall and provides pasture during the winter and spring. Where once established on such pastures it reproduces itself continuously. On Bermuda-grass pastures where bur-clover is not established, it is recommended that furrows be plowed through the Bermuda grass from 5 to 10 feet apart and seed of bur-clover, preferably in the bur, be sown in these plowed furrows in September. Within a year or two the plants produced in these plowed furrows will seed the whole pasture. Disking such a pasture in summer tends to stimulate the Bermuda grass. Broadcasting about 1 bushel of bur-clover seed in the bur to each acre before disking the Bermuda grass will usually give a stand of the bur-clover.

### **USE AS A COVER AND GREEN-MANURE CROP**

Bur-clover alone is commonly used as a green-manure crop in the orchards of California and is often so handled that good volunteer crops are obtained year after year.

In the South, undoubtedly the greatest value of bur-clover is the fact that it is the cheapest and most easily handled legume that

can be used as a combination cover and green-manure crop. Even a growth only a few inches in height is sufficient to prevent to a large degree the washing of the land in winter and, when plowed under, to add sufficient humus and nitrogen to improve materially the following cotton crop. It is the most economical legume to use for this purpose, as when once a stand has been obtained and rows of the plants are left to seed, it will volunteer from year to year. The same method can be used with corn or any other intertilled summer crop.

There is some difficulty in seeding bur-clover in standing cotton, as in the harrowing of the bur-clover seed some of the ripe cotton is pulled out of the bolls. For this reason, the harrowing should be done just after the pickers have been through the field, thus avoiding as far as possible any injury to the opened bolls. When or where there is objection to using the balk system just described, corn can be grown occasionally in rotation with the cotton. As previously stated, it is possible to have a good stand of bur-clover each year without annual seeding by allowing a bur-clover crop to mature seed once every 4 or 5 years, and in that year, after plowing the bur-clover under, planting a crop of late corn as the season's cash crop. This is perhaps the most extensively used system in growing bur-clover with cotton.

There are many farm records that show that by using bur-clover in rotation with cotton the yields of cotton have shown marked increase year after year. There is apparently no other legume that can be used with as low cost as bur-clover for this purpose. The use of a summer legume crop, such as cowpeas or soybeans, is advisable in good rotations, but where cotton is grown continuously it involves the omission of this crop for an entire growing season. It is much cheaper and much more satisfactory to use bur-clover, which, after it is once established, does not involve much expense for producing seed or require the loss of a growing season, as does a summer legume crop. Furthermore, it adds each year a reasonable quantity of humus and nitrogen, which in the end gives much more satisfactory results than turning under a large green-manure crop at long intervals. Perhaps no one thing will tend to bring about an increased yield from cottonfields more cheaply than the general use of bur-clover as winter cover and a green-manure crop.

### VALUE AS HAY

Under favorable conditions bur-clover will make a dense stand 18 to 24 inches high. From such dense stands of bur-clover, yields of 2 or even 3 tons of hay per acre have been recorded. Unless the stand is very dense, however, bur-clover plants lie close to the ground, and mowing is very difficult. If bur-clover is to be grown for hay, it is preferably sown in mixture with oats or wheat, as with these grain crops the bur-clover plants tend to grow erect. Ordinarily about 5 bushels of bur-clover seed in the bur should be sown to the acre, together with 2 bushels of winter oats or  $1\frac{1}{2}$  bushels of wheat. For growing in this manner, however, hairy vetch is preferable to bur-clover, and even crimson clover will ordinarily give larger yields under such conditions than bur-clover. Bur-clover hay is not regarded very highly and is seldom used.

## GROWING AND HARVESTING SEED

### CALIFORNIA BUR-CLOVER

Most of the commercial seed of California bur-clover comes from California. Much of the seed is harvested as an impurity with wheat and other grain crops, from which it is separated at the mills and warehouses handling grain. Occasionally some seed is harvested from pasture lands where burs in pure stands are often produced in abundance. The simplest method of harvesting is sweeping by hand with large stiff brooms. Ordinary mowers, self-rake reapers, combine harvesters, and specially devised suction machines have also been used. When the mower, reaper, or harvester is used, the crop must be cut before all the seeds are ripe, because the burs ripen unevenly and drop readily when ripe. As a consequence, a good deal of green material is harvested with the burs, which necessitates careful drying to prevent damage by heating and sweating. Furthermore, because of the half-prostrate habit of the plants, a large part of the crop is left on the ground.

The power suction machine saves all the seed, but the cost of operation is high. When this machine is used the burs are allowed to become perfectly dry, so that they are easily lifted from the ground by air suction.

When only a small quantity of seed is to be saved, the best method is to sweep by hand. When this method is used the seed is allowed to ripen thoroughly and the vines are cut with an ordinary mowing machine and raked into windrows. The burs are swept together with large barn brooms and hauled from the field. The burs gathered in this manner are mixed with more or less gravel and other foreign substances, which must be removed before the seed can be satisfactorily hulled or used in the bur. This separation is accomplished by the use of handbarrow screens and an ordinary fanning mill regulated to blow the burs over; or, if running water is handy, a quicker and more satisfactory method is to throw the burs into the water. All heavy substances sink, and the burs and lighter substances are dipped from the stream. To facilitate separation, the channel of the stream should be narrowed in the shape of an open V, which aids in collecting the clean burs. To dip the burs from the water, a large handbarrow with a bottom made of wire netting has been found satisfactory. The burs are spread on canvas to dry, after which they may be successfully hulled with an ordinary clover huller.

A second source of the seed of California bur-clover, often mixed with spotted bur-clover, has been from the burs removed from wool. The quantity of these burs contained in wool is so large that it has been found profitable to save the seed in European wool-cleaning mills. Bur-clover of one or both species is abundant in Argentina and also in Australia, as well as in the Mediterranean countries.

### SPOTTED BUR-CLOVER

Practically all the commercial seed of spotted bur-clover is grown in the cotton States. Thus far the seed has been marketed only in the bur, but hulled seed could easily be produced in commercial quantities should a demand for it develop.

On small farms, raking or sweeping the ripened pods from the ground is the common method used in harvesting spotted bur-clover seed. It is best to allow the burs to become perfectly mature or dry before harvesting. At this time the vines can be raked with a horse rake without previous cutting, leaving the shattered burs on the ground. Another raking with a hand rake usually will be necessary in order to remove trash that slips between the teeth of the horse rake. When the pods are not perfectly dry, care must be exercised in curing, as otherwise the piles will heat, with consequent injury to the seeds. It is probably because of such heating that the commercial seed so often has a low percentage of germination.

Every southern farmer can easily grow his own supply of bur-clover seed at small expense.

On large farms, specially constructed suction machines are used for gathering or harvesting the dry burs from the ground, and this is the source of most of the spotted bur-clover seed on the market.

### YIELD AND WEIGHT OF SEED

Bur-clover seed closely resembles that of alfalfa. Formerly much of it was used to adulterate alfalfa seed, but this practice is now rare, because of the enforcement of pure-seed laws. The two kinds of bur-clover may be distinguished by their seeds (figs. 6 and 7) as well as by their burs.



Figure 6.—Seeds of spotted bur-clover.



Figure 7.—Seeds of California bur-clover.

### CALIFORNIA BUR-CLOVER

The average yield of hulled seeds in California is from 300 to 500 pounds per acre. The seeds weigh about 60 pounds to the bushel. One bushel of clean, dry burs weighs 6 to 12 pounds and contains 2 to 4 pounds of seed.

### SPOTTED BUR-CLOVER

From a good stand the average yield of burs per acre in the South is about 500 pounds, but yields of 1,200 or even 1,500 pounds per acre are recorded. One bushel of spotted bur-clover seed in the bur weighs from 6 to 14 pounds. One hundred pounds of the clean burs contain 30 pounds of seed. The yield of clean seed per acre is therefore 150 to 360 pounds, or about half the yield of California bur-clover seed obtained in California.

### INSECT ENEMIES

The only insect that does any serious damage to bur-clover is the clover seed chalcid, which also attacks red clover and alfalfa.

This small, wasplike insect lays its eggs through the green pods into the soft seeds, where they hatch and develop, becoming mature insects and emerging by the time the seeds are ripe, or later. The quantity of seed thus destroyed is considerable. In California probably 10 percent of the early-maturing seed is destroyed, and as much as 75 percent of the late seed. In the South the loss is probably not so great. No practical way of controlling this insect in bur-clover is known. It does no harm to the herbage.

### OBJECTIONS TO BUR-CLOVER

Three objections have been advanced against the use of bur-clover as a forage crop:

(1) The relative unpalatability of the plant. This is most marked in the case of horses and mules, but other animals do not take to it readily at first. However, all farm animals kept on pastures soon acquire a taste for bur-clover and then eat it freely.

(2) The small quantity of growth. This objection applies mainly to poor soils and to the northern parts of the Cotton Belt. Even where the growth is very small it is practically always sufficient to prevent the washing of the soil, and this, together with the very insignificant cost of obtaining a stand each year and the marked ability of the plant to grow in cool weather, makes it valuable, even though the growth is not large.

(3) The burs become entangled in the wool of sheep and thus reduce the value of the wool. This objection applies particularly to California and other regions where bur-clover is abundantly established on range lands. The value of the forage, however, far outweighs the small damage done by the burs. On cultivated land the objection scarcely applies, as the difficulty is easily avoided by removing the sheep from the pasture after the burs are ripe, or else pasturing the bur-clover so heavily that only a few burs are formed. It is mainly on account of this objection that a spineless variety of bur-clover is considered desirable on cultivated land.